Remarks

1. In the detailed description of figure 8, on page 12, "Spacing 15" has been amended to "Spacing 16". The informality cited by the examiner should now be appropriately corrected.

2. Claims 1 and 2 were rejected under 35 U.S.C. 102(b) as being anticipated by Netzer or Larson.

Claim 1 of the Application, as amended, claims a capacitive sensor, comprising "...at least two coplanar electrical conductors attached to a substrate and electrically insulated from one another, the conductors separated from one another by spacing, the spacing equal to at least two times the thickness of the dielectric wall, the conductors forming a fringing field capacitance, ...". Thus, the present invention utilizes conductor spacing, and other geometrical constraints, to achieve a desirable increase in sensitivity to the measured fluid as compared to an undesirable sensitivity to the dielectric material between the conductors, to the dielectric wall of the vessel, as well as to minimize other properties of the dielectric wall, such as temperature sensitivity of its dielectric constant, contamination, or splashing of the fluid onto it. This is contrary to the teaching of Netzer, in which an alternative method is taught to attempt to achieve a reduction in sensitivity to contamination or splashing. In column 10, line 51, Netzer teaches additional conductor(s) 405, to be utilized and grounded "...to minimize the effects of contamination and splashes...".

In Larson. column 4, line 49, differentiator means is taught for the purpose of measuring the level of liquid 31, so that the "The capacitive component of the liquid adhering to the walls of tank 11 will be extremely small compared to the capacitance of the bulk liquid 11...". This is contrary to the teaching of the present Application, in which sensitivity to splashing of the fluid onto the vessel wall is minimized through controlling geometric constraints, such as conductor spacing.

Netzer does not teach or claim a desirable spacing between conductors 402-405. Figure 2 shows that an electromagnetic field penetrates into the measured liquid, but any arrangement of electrodes energized by an alternating electromagnetic field will accomplish this to some degree. And in fact, the apparent dimensions shown in figure 2, with d obviously much smaller than D, are contrary to the present Application. The present Application, claims a spacing of at least two times the thickness of the dielectric wall (in claim 1, as amended).

Likewise, Larson does not teach or claim a desirable spacing between conductors.

Therefore, in their present form, as amended, claims 1 and 2 should now be in allowable form.

3. Claim 3 was rejected under 35 U.S.C. 102(b) as being anticipated by Larson.

In Larson, a portion of the dielectric material 11 is shaped such that a depression is formed in the surface of the sensing element facing the fluid 31 (Fig. 2A). In Larson Fig. 2A, the depression cited forms what is called the vessel in the present Application, for containing the fluid to be measured. Conductors 12 and 13 in Larson Fig. 2A oppose each other with the measured liquid in-between. This constitutes a uniform field capacitance sensor, with the measured liquid filling the cited depression.

In claim 3 of the present Application, as amended, the conductors are coplanar and attached to a substrate, forming a fringing field capacitance sensor, with the coplanar conductors separated by spacing. A gap is formed in the surface of the substrate, such as gap 26 in figure 12, for example. This gap avoids the presence of at least a part of the substrate material between the conductors, and serves to reduce the starting capacitance of the sensing element, thus increasing the sensitivity to the measured liquid.

Thus, it can be seen that the depression cited in Larson figure 2A, is not similar to the "opening, gap, or depression" of the present Application, as amended.

Claim 3 should now be in allowable form.

4. Claims 4, 5, 7, 12 and 15 were rejected under 35 U.S.C. 102(b) as being anticipated by Netzer.

Claim 4 is cited by the examiner as being anticipated by the flexible plastic sheet of Netzer. In claim 4, as amended, the main usefulness of the flexible sensing element is due to the geometric configuration of the widths and spacing of the conductors, and compared to the thickness of the dielectric wall. This allows a flexible sensor with a simple electrode configuration to be fabricated inexpensively. In order to achieve the more complicated three-electrode (402-404) sensor configuration of Netzer, along with the addition of ground lines 405 that are needed to see through a dielectric wall, and printed conductive carbon, a resulting flexible sensing element will be more expensive and prone to damage from flexing, as compared to the simple design of the present Application.

Claim 4 of the present Application, as amended, depends on claims 1 and 2, and should now be in allowable form.

Claim 5 was rejected by the examiner because Netzer's sensing element has a configuration that allows it to be cut to length. Applicant has canceled claim 5 of the application.

Claim 7 was rejected because Netzer teaches a grounded shield parallel to the sensing element. The shield of Netzer, however is taught to be on the opposite side of a substrate on which the sensing conductors are formed on the opposite face. This is contrary to the teaching and claims of the present Application. Fringing field sensors according to Netzer are formed either "on a thin non conductive substrate" column 4, line 1 (such as a typical printed circuit board construction), or "a flexible plastic sheet, such as Mylar"

column 9, line 53. But in fact, according to experiments by the present inventor before preparation of the original application, use of such a relatively thin dielectric layer between the conductors and the shield drastically reduces the usefulness of the sensor by greatly increasing the starting capacitance.

According to the present invention and Application, conductor width and spacing required for improved sensitivity are also relative to the distance between the sensing conductors and the measured liquid (usually through a dielectric wall). Preserving this improved sensitivity while applying a shield requires a spacing to be maintained between the conductors and the shield, and any material within that spacing must be of a low dielectric constant, such as a foamed dielectric material as taught in the present Application.

Claim 7 of the application, as amended, depends on claims 1 and 6. For the reasons cited above, Claim 7 in its amended form is not anticipated by Netzer, and should now be in an allowable form.

Claims 12 and 15 were rejected due to similar teachings by Netzer. Applicant has amended the application to delete claim 15.

Claim 12, as amended, teaches a sensor that is embedded within a dielectric wall such that the sensor is not positioned on the outside of either the inner or outer surface of the dielectric wall. The conductors and spacer are geometrically configured to enhance the ability of the sensor to read the fluid level through the dielectric wall. This is not according to any teachings of Netzer or other patents. Therefore claim 12, as amended, should now be in allowable form.

5. Claim 6 was rejected under 35 U.S.C 103(a) as being unpatentable over Netzer in view of Koon. The utility of the present invention is not only the capability to be adhesively attached to a vessel wall, but also, through the use of a low dielectric spacer of controlled thickness, and a shield conductor thus spaced, to maintain good sensitivity of the level measurement while reducing sensitivity to, and generation of, electrical noise. This is not taught in Netzer or Koon. Claim 6, as amended, should now be in allowable form.

6. Claims 8, 9, 11, 13, 14, and 16 were rejected under 35 U.S.C 103(a) as being unpatentable over Netzer in view of Koon.

Applicant has canceled claims 8, 9, 11, 14, and 16 of the original application.

Claim 13 of the application has been amended to specify the features that provide improved sensitivity.

Rather than being a simple and efficient means for monitoring fluid level, as cited by the examiner, the Application teaches a preferred geometrical configuration of the conductor widths and spacing, such that an embedded sensing element will have improved sensitivity to the measured liquid.

As amended, claim 13 should now be in allowable form.

7. Claim 10 was rejected under 35 U.S.C 103(a) as being unpatentable over Larson in view of König. Applicant has canceled claim 10.

Claim 16 was rejected under 35 U.S.C. 112, "the vessel" lacks antecedent basis. Applicant has canceled claim 16.

7. Applicant has added claims 17 and 18, based on specific teachings of the present application.

Applicant's Request

Reconsideration of the Application as amended and allowance thereof are requested. In commenting on the references and in order to facilitate a better understanding of the differences that are expressed in the claims, certain details of distinction between the references and the present invention have been mentioned, even though such differences do not appear in all of the claims. Not all of the distinctions between the Prior Art and Applicant's present invention have been made by the Applicant. For these reasons, Applicant reserves the right to submit additional evidence showing the distinction between Applicant's invention and Prior Art to be unobvious in view of the Prior Art.

The foregoing remarks are intended to assist the Office in examining the Application and in the course of explanation may employ shortened or more specific or variant descriptions of some of the claim language. Such descriptions are not intended to limit the scope of the claims; the actual claim language should be considered in each case. Furthermore, the remarks are not to be considered to be exhaustive of the facets of the invention which are rendered patentable, being only examples of certain advantageous features and differences which Applicant chooses to mention at this time.

Respectfully submitted,

David S. Nyce
2633 Whistling Quail Run
Apex, NC 27502

Amendments to the Drawings

The drawings are amended as follows:

Add the number 3, and the associated arrow, to Figure 4.

Correct the positioning of numbers 1,2,3 and 7, and add numbers 27 and 28 to figure 5, View from edge.

The amended sheets are attached.